PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant :	James V. Candy et al.	Docket No. :	IL-10941
Serial No. :	10/661,249	Art Unit :	3737
Filed :	09/11/2003	Examiner :	James M. Kish
For :	DYNAMIC ACOUSTIC FOCUSING UTILIZING TIME REVERSAL		

Honorable Commissioner for Patents
Alexandria, VA 22313-1450

Attention: Board of Patent Appeals and Interferences

Dear Sir:

APPELLANTS' BRIEF (37 C.F.R. § 1.192)

This brief is submitted in support of Appellants' notice of appeal from the Final Rejection, mailed August 15, 2008 finally rejecting claims 4-8, 21-25, 41-45, and 61-65 of the subject application.

Appellants' notice of appeal was filed November 11, 2008.

One copy of the brief is being transmitted per 37 C.F.R. § 41.37.

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I. REAL PARTY IN INTEREST

The real party in interest is:

Lawrence Livermore National Security, LLC and the United States of America as represented by the United States Department of Energy (DOE) by virtue of an assignment by the inventor as duly recorded in the Assignment Branch of the U.S. Patent and Trademark Office.

II. RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences.

III. STATUS OF CLAIMS

The application as originally filed contained claims 1-94.

The claims on appeal are claims 4-8, 21-25, 41-45, and 61-65.

The status of all the claims in the proceeding (*e.g.*, rejected, allowed or confirmed, withdrawn, objected to, canceled) is:

Claims 4-8, 21-25, 41-45, and 61-65 are rejected.

Claims 1-3, 9-20, 26-40, 46-60, and 66-94 are cancelled.

Claims 4-8, 21-25, 41-45, and 61-65 on appeal are reproduced in the Appendix.

IV. STATUS OF AMENDMENTS

There have been no amendments filed subsequent to the Final Rejection mailed August 15, 2008.

V. SUMMARY OF CLAIMED SUBJECT MATTER

Appellant's invention is illustrated in FIGS. 1 and 10 reproduced below and described in the portions of the specification which are quoted below.

[0008] The present invention provides a method of noninvasively focusing acoustical energy on a mass within a substance to reduce or eliminate the mass. The presence of the mass in the substance is detected by applying acoustic energy to the substance. The mass is localized to determine its position within the substance. Temporal signatures are developed to drive the acoustical energy on the mass. Dynamic focusing of the acoustical energy on the mass in the substance to reduce or eliminate the mass is accomplished utilizing the temporal signatures. In one embodiment the dynamic focusing of the acoustical energy on the mass utilizes time reversal. In another embodiment, the focusing of acoustical energy on a mass utilizes modeling and time reversal. In another embodiment, the focusing of acoustical energy on a mass utilizes modeling. (Page 4, lines 4-14 of Appellants' Specification)

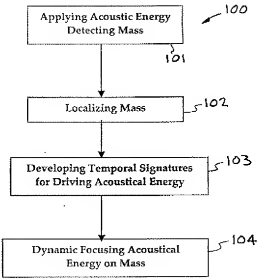


FIG. 1

[0013] Referring now to the drawings and in particular to FIG. 1, a conceptual illustration of a system constructed in accordance with the present invention is illustrated. The system is designated generally by the reference numeral 100. The system provides methods and apparatus for noninvasively focusing acoustical energy on a mass within a substance to reduce or eliminate the mass. Acoustic energy is applied to the substance 101. The mass is localized 102 to determine its position within the substance. Temporal signatures are developed for driving acoustical energy on the mass 103. Dynamic focusing of

acoustical energy on the mass 104 utilizing the temporal signatures reduces or eliminates the mass. In some embodiments the dynamic focusing of acoustical energy on the mass is accomplished utilizing time-reversal. In other embodiments the dynamic focusing of acoustical energy on the mass is accomplished utilizing modeling. (Page 6, lines 9-20 of Appellants' Specification)

[0016] The dynamic focusing of acoustic energy is a technique that impacts a large number of applications ranging from noninvasively focusing acoustical energy on a mass within a substance to detecting and reducing or eliminating flaws in components. In the medical area, the system 100 has application in noninvasive tissue mass removal, non-invasive tumor/cyst destruction and treatment, and acoustic surgery. Treatment of tissue can be directly destructive through thermal or mechanical mechanisms, or indirectly destructive through localized enhancement of radiotherapy or chemotherapy caused by exposure to ultrasound. The system 100 has the prospect of opening new frontiers with the implication of noninvasive treatment of masses along with the expanding technology of acoustic surgery. The system 100 also has application in mass imaging, nondestructive evaluation of materials, secure communications, seismic detection of underground masses, and other applications. (Page 7, lines 18-27 and page 8, lines 1-4 of Appellants' Specification)

[0075] FIGS. 1-10 and the description above describe a system for treating tissue containing a mass to reduce or destroy the mass. The presence of a tissue mass is detected by applying acoustic energy into the tissue using an array of ultrasonic transducers. The amount of energy scattered by the mass depends on its acoustic parameters (density, sound speed, attenuation, etc.). Once it is detected, the mass is localized to determine its position within the tissue medium. When the mass is detected and localized, "zonal" focusing is performed to extract or zoom in on the tissue mass under scrutiny. Once detected and localized, temporal signatures are developed to "drive" the array and focus increased energy back onto the mass. Increased acoustic energy is transmitted back onto the mass to treat the mass and/or provide the treatment. The forms of treatment include, Ultrasound thermal therapy: hyperthermic applications, ultrasound thermal therapy: non-invasive surgery, ultrasound non-thermal therapy: controlled cavitation, and other treatments. Embodiments of the invention provide evaluation of the treatment. After the treatment, acoustic energy is propagated into the tissue using an array of ultrasonic transducers to evaluate the treatment.

Appellant's four (4) independent claims 4, 21, 41, and 61 are "read on" Appellants' specification as follows:

Claim 4	Specification & Drawings
A method of noninvasively focusing acoustical energy on a mass within a substance to reduce or eliminate said mass, comprising the steps of:	The present invention provides a method of noninvasively focusing acoustical energy on a mass within a substance to reduce or eliminate the mass. (Page 4, lines 4-6)
detecting the presence of said mass in said substance by applying acoustic energy to said substance,	The presence of the mass in the substance is detected by applying acoustic energy to the substance. (Page 4, lines 6-7)
localizing said mass to determine its position within said substance,	The mass is localized to determine its position within the substance. (Page 4, lines 7-8)
developing temporal signatures to drive said acoustical energy on said mass, and	Temporal signatures are developed to drive the acoustical energy on the mass. (Page 4, lines 8-9)
dynamic focusing said acoustical energy on said mass in said substance utilizing said temporal signatures to reduce or eliminate said mass, wherein said step of dynamic focusing said acoustical energy on said mass utilizes time reversal eigen-decomposition.	Dynamic focusing of the acoustical energy on the mass in the substance to reduce or eliminate the mass is accomplished utilizing the temporal signatures. (Page 4, lines 9-11) Referring now to FIG. 10, the eigen-decomposition time-reversal technique is shown. (Page 36, lines 1-2) The eigen-decomposition technique allows one to predetermine the number of distinguishable scatterers, select one scatterer 1003 of interest, then apply the time-reversal technique to focus on that scatterer. (Page 36, lines 6-9)

Claim 21	Specification & Drawings
A method of treating tissue by noninvasively focusing acoustical energy on a mass within said tissue to reduce or eliminate said mass, comprising the steps of:	In one embodiment, the present invention provides a method of treating tissue by noninvasively focusing acoustical energy on a mass within the tissue to reduce or eliminate the mass. (Page 4, lines 15-17)
detecting the presence of said mass in said tissue by applying acoustic energy to said tissue,	The embodiment comprising the steps of detecting the presence of the mass in the tissue by applying acoustic energy to the tissue, (Page 4, lines 17-19)
localizing said mass to determine its position within said tissue,	localizing the mass to determine its position within the tissue, (Page 4, lines 17-19)
developing temporal signatures to drive said acoustical energy on said mass, and	developing temporal signatures to drive the acoustical energy on the mass, (Page 4, line 20)
dynamic focusing said acoustical energy on said mass in said tissue utilizing said temporal signatures to reduce or eliminate said mass wherein said step of dynamic focusing said acoustical energy on said mass utilizes time reversal eigen-decomposition.	dynamically focusing the acoustical energy on the mass in the tissue utilizing the temporal signatures to reduce or eliminate the mass. (Page 4, lines 20-21) Referring now to FIG. 10, the eigen-decomposition time-reversal technique is shown. (Page 36, lines 1-2) The eigen-decomposition technique allows one to predetermine the number of distinguishable scatterers, select one scatterer 1003 of interest, then apply the time-reversal technique to focus on that scatterer. (Page 36, lines 6-9)

Claim 41	Specification & Drawings
A system of noninvasively focusing acoustical energy on a mass in a substance to reduce or eliminate said mass, comprising:	The system provides methods and apparatus for noninvasively focusing acoustical energy on a mass within a substance to reduce or eliminate the mass. (Page 6, lines 12-14)
means for applying acoustic energy to said substance for detecting said mass,	Apparatus of the system 100 comprise means 101 for transmitting an initial acoustic signal into the substance for detecting the mass, (Page 7, lines 5-6)
means for localizing said mass,	means 102 for localizing the mass, (Page 7, lines 6-7)
means for developing temporal signatures for driving said acoustical energy, and	means 103 for developing temporal signatures for driving the acoustical energy, and (Page 7, lines 7-8)
means for dynamic focusing said acoustical energy through said substance on said mass to reduce or eliminate said mass wherein of means for dynamic focusing said acoustical energy on said mass utilizes time reversal eigen-decomposition.	means 104 for dynamically focusing the acoustical energy through the substance onto the mass to reduce or eliminate the mass. (Page 7, lines 8-9) Referring now to FIG. 10, the eigen-decomposition time-reversal technique is shown. (Page 36, lines 1-2) The eigen-decomposition technique allows one to predetermine the number of distinguishable scatterers, select one scatterer 1003 of interest, then apply the time-reversal technique to focus on that scatterer. (Page 36, lines 6-9)

Claim 61	Specification & Drawings
A system of treating tissue by treating tissue within said tissue to reduce or eliminate said mass, comprising:	The system provides methods and apparatus for noninvasively focusing acoustical energy on a mass within a substance to reduce or eliminate the mass. (Page 6, lines 12-14) In the medical area, the system 100 has application in noninvasive tissue mass removal, non-invasive tumor/cyst destruction and treatment, and acoustic surgery. (Page 7, lines 20-22)
means for applying acoustic energy to said substance for detecting said mass,	Apparatus of the system 100 comprise means 101 for transmitting an initial acoustic signal into the substance for detecting the mass, (Page 7, lines 5-6)
means for localizing said mass,	means 102 for localizing the mass, (Page 7, lines 6-7)
means for developing temporal signatures for driving said acoustical energy, and	means 103 for developing temporal signatures for driving the acoustical energy, and (Page 7, lines 7-8)
means for dynamic focusing said acoustical energy through said substance on said mass to reduce or eliminate said mass wherein said means for dynamic focusing said acoustical energy on said mass utilizes time reversal eigen-decomposition.	means 104 for dynamically focusing the acoustical energy through the substance onto the mass to reduce or eliminate the mass. (Page 7, lines 8-9) Referring now to FIG. 10, the eigen-decomposition time-reversal technique is shown. (Page 36, lines 1-2) The eigen-decomposition technique allows one to predetermine the number of distinguishable scatterers, select one scatterer 1003 of interest, then apply the time-reversal technique to focus on that scatterer. (Page 36, lines 6-9)

The means plus function and the structure, material, or acts described in the specification of Appellant's dependent claims 42 and 62 argued separately are "read on" Appellants' specification as follows:

Claim 42	Specification & Drawings
The system of noninvasively focusing acoustical energy on a mass of claim 41	The system provides methods and apparatus for noninvasively focusing acoustical energy on a mass within a substance to reduce or eliminate the mass. (Page 6, lines 12-14)
wherein said means for developing temporal signatures for driving said acoustical energy includes	means 103 for developing temporal signatures for driving the acoustical energy, and (Page 7, lines 7-8)
means for acquiring a multistatic data matrix that uses sets of orthogonal weights to increase signal-to-noise ratio.	Using the orthogonality of the set of weights, this N by N signal array can be transformed into the multistatic data matrix required for the eigen-decomposition technique. (Page 36, lines 25-27)

Claim 62	Specification & Drawings
The system of treating tissue of claim 61	In the medical area, the system 100 has application in noninvasive tissue mass removal, non-invasive tumor/cyst destruction and treatment, and acoustic surgery. (Page 7, lines 20-22)
wherein said means for developing temporal signatures for driving said acoustical energy includes	means 103 for developing temporal signatures for driving the acoustical energy, and (Page 7, lines 7-8)
means for acquiring a multistatic data matrix that uses sets of orthogonal weights to increase signal-to-noise ratio.	Using the orthogonality of the set of weights, this N by N signal array can be transformed into the multistatic data matrix required for the eigen-decomposition technique. (Page 36, lines 25-27)

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The Final Rejection mailed August 15, 2008 states two (2) grounds of rejection. The two grounds of rejection are summarized as follows:

Grounds of Rejection #1 - Claims 4, 21, 41, and 61 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fink U.S. Patent No. 5,092,336 (hereinafter "Fink") in view of Prada, Elsevier Sciences B.V., *Wave Motion* 20 (1994)151-163, (hereinafter "Prada"). The rejection is stated in the first paragraph on page 4 of the Final Rejection mailed August 15, 2008.

Grounds of Rejection #2 - Claims 5-8, 22-25, 42-45, and 62-65 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fink in view of Prada and further in view of Candy U.S. Published Patent Application No. 2001/0037075 (hereinafter "Candy"). The rejection is stated in the first paragraph on page 5 of the Final Rejection mailed August 15, 2008.

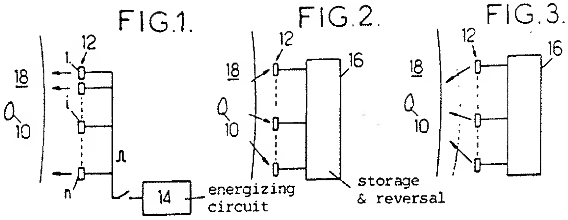
VII. ARGUMENT

Argument Relating to Grounds of Rejection #1

The rejection in grounds of rejection #1 is respectfully traversed because claims 4, 21, 41, and 61 are not obvious over the Fink and Prada references and Appellants' claims 4, 21, 41, and 61 are patentable.

The Fink Reference

The Fink reference is U.S. Patent No. 5,092,336 illustrated in FIGS. 1, 2, and 3 reproduced below and described in the portions of the Fink reference in column 4 lines 55-68 and column 5, lines 1-51 quoted below.



"As shown in FIGS. 1 to 3, implementation of the process of the invention requires forming, starting from a target constituting a secondary source 10, an ultrasonic pressure field focussed on the target, by an ultrasonic phase conjugation mirror technique.

The target may for instance be a stone to be destroyed in human tissues. It may also be a fault in a solid part.

During a first step, the zone in which a target 10 is to be localized is illuminated with a wide non-focused beam (FIG. 1). The beam may be supplied by an array 12 of ultrasonic transducers 1, 2, . . . , i, . . . , n which will again be used during the following steps. The transducers will generally be distributed in a two-dimensional array 12, although the Figures show the transducers distributed along a line, namely a one-dimensional array, for greater simplicity. The array may be flat or concave so as to provide geometric prefocusing when that is necessary for destroying the target by ultrasonic energy. The transducers may be of conventional construction and formed as piezo-electric ceramic wafers. It will often be advantageous to use transducers having a central resonance frequency of about 500 kHz for lithotripty. For medical use, the array may comprise transducers spaced apart by 3 to 6 wavelengths if placed on a concave surface, by 1 to 4 wavelengths in the case of a flat surface. The array may typically be designed to be placed at a distance from the calculus to be destroyed between 100 and 200 millimeters.

The array 12 may have one of the general constructions well known at the present time, so that it is not necessary to describe it further.

Array 12 is associated with a first circuit 14 for energizing the transducers by signals so shaped and distributed that the array delivers an unfocused beam directed toward the target 10 which, due to reflection from its surface, will

constitute a secondary source. In practice, circuit 14 may be a generator of short pulses driving all the transducers in phase. A special array of transducers or some of the transducers may be used during this step instead of the complete array 12.

During a second step of the process, the echo received by the transducers 1, . . . , i, . . . , n is transformed into electric signals and the shapes and relative positions in time of the signals are stored by a circuit 16 (FIG. 2) which may have the construction which will be described with reference to FIG. 4. FIG. 2A shows the general shapes and time distribution of electric signals which may appear at the outputs of the different transducers when the electric signal energizing the transducers (FIG. 1) is a short pulse.

During the next step, the stored signals are used for generation of signals energizing the transducers of the reception array 12, after reversal of the distribution in time and of the shape of the signal (FIG. 3). To the extent that the transducers have a linear response and/or have the same response characteristic at emission and at reception, the returned wave front resulting from energization of the array 12 is focused on the target 10, the distortions appearing on the outgoing path through the possibly inhomogeneous medium 18 (FIG. 2) being exactly compensated for by the distortions on the return path. The divergent ultrasonic wave picked up by array 12 (FIG. 2) is used to generate an exactly focused convergent wave (FIG. 3).

The Prada Reference

The Prada reference is Elsevier Sciences B.V., *Wave Motion* 20 (1994)151-163 described in the "Abstract" and "Conclusion" as follows:

"**Abstract** - The iterative time reversal minor provides an elegant way of focusing in multiple target media on the most reflective one. This paper presents a method to focus on the other targets. It is derived from a theoretical study of the iterative time reversal process. The iterative process can be described at each frequency by a time reversal operator which can be diagonalized. The eigenvectors of this operator are eigenmodes of the time reversal process. In the case of well resolved targets of different "brightness", the rank of the time reversal operator is equal to the number of targets and each eigenvector of non zero eigenvalue provides the optimal phase and amplitude law to focus on the corresponding target. An experimental validation of these results is given."

"**Conclusion**" - The goal of this paper was to present a new method of detection and selective focusing in multiple target media. The method is based on the

time reversal concept. We introduced a time reversal operator, the eigenvectors of which are linked to the targets. The eigenvalue depends on the reflectivity of the target and the eigenvector provides the phase and amplitude law to focus on the target. The theoretical and experimental results show the efficiency of the method.

The problem solved by the Prada reference is stated in the left column of page 152 as follows:

> "Unfortunately, these methods require a pointlike scatterer. They are not efficient if there are several targets. Furthermore they assume that the propagating medium only induces time delay distortion in the wavefront. In many cases, a wave propagating in an inhomogeneous medium is not only delayed but its spatial and temporal shape is also distorted through refraction, diffraction and multiple scattering. These distortions are not taken into account by time delay focusing.
>
> The time reversal operation is an elegant way of avoiding all these problems. The geometrical errors as well as the sound speed fluctuations are compensated automatically by this self-adaptive process. Further-more, if there are several targets, the time reversal process can be iterated in order to focus one the most reflective ones."

<u>There is No *Prima Facie* Case of Obviousnes</u>

There is no *Prima Facie* case of obviousness that would support the rejection of claims 4, 21, 41, and 61 over the Fink and Prada references under 35 U.S.C. § 103(a). The factual inquiries set forth in Graham v. John Deere Co., 383 U.S. 1, 148 USPQ 459 (1966) that are applied for establishing a background for determining obviousness under 35 U.S.C. § 103(a) include, "Ascertaining the differences between the prior art and the claims at issue." The Examiner bears the initial burden of factually supporting a *prima facie* conclusion of obviousness (M.P.E.P. Section 2142). Three basic criteria must be met in order for the Examiner to establish a *prima facie* case of obviousness.

Criterion 1 - The prior art reference (or reference when combined) must teach or suggest all the claim limitations.

Criterion 2 - There must be a reasonable expectation of success with the proposed combination.

Criterion 3 - The Examiner must follow the "Examination Guidelines for Determining Obviousness in Light of the Supreme Court's KSR v. Teleflex Decision" published October 10, 2007. These guidelines include the requirement that the Examiner provide reasons for combining the references to produce the proposed combination.

Criterion 1 - References Do Not Teach All Claim Limitations

The criterion that prior art reference, or references when combined, must teach or suggest all the claim limitations can not be met. With reference to the descriptions of the Fink and Prada references above, it is clear that the references fail to teach the following combination of claim limitations of Applicants' claims 4, 21, 41, and 61:

> **Claim 4**
> "A method of noninvasively focusing acoustical energy on a mass within a substance to reduce or eliminate said mass, comprising the steps of:" "detecting the presence of said mass in said substance by applying acoustic energy to said substance," "localizing said mass to determine its position within said substance," "developing temporal signatures to drive said acoustical energy on said mass," and "dynamic focusing said acoustical energy on said mass in said substance utilizing said temporal signatures to reduce or eliminate said mass, wherein said step of dynamic focusing said acoustical energy on said mass utilizes time reversal eigen-decomposition."
>
> **Claim 21**
> "A method of treating tissue by noninvasively focusing acoustical energy on a mass within said tissue to reduce or eliminate said mass comprising the steps of:" "detecting the presence of said mass in said tissue by applying acoustic energy to said tissue," "localizing said mass to determine its position within said tissue," "developing temporal signatures to drive said acoustical energy on said mass," and "dynamic focusing said acoustical energy on said mass in said tissue utilizing said temporal signatures to reduce or eliminate said mass wherein said step of dynamic focusing said acoustical energy on said mass utilizes time reversal eigen-decomposition."

Claim 41
"A system of noninvasively focusing acoustical energy on a mass in a substance to reduce or eliminate said mass, comprising" "means for applying acoustic energy to said substance for detecting said mass," "means for localizing said mass," "means for developing temporal signatures for driving said acoustical energy," and "means for dynamic focusing said acoustical energy through said substance on said mass to reduce or eliminate said mass wherein of means for dynamic focusing said acoustical energy on said mass utilizes time reversal eigen-decomposition."

Claim 61
"A system of treating tissue by treating tissue within said tissue to reduce or eliminate said mass, comprising" "means for applying acoustic energy to said substance for detecting said mass," "means for localizing said mass," "means for developing temporal signatures for driving said acoustical energy," and "means for dynamic focusing said acoustical energy through said substance on said mass to reduce or eliminate said mass wherein said means for dynamic focusing said acoustical energy on said mass utilizes time reversal eigen-decomposition."

Thus, the combination of the Fink and Prada references in the Final Rejection mailed August 15, 2008 fails to support a rejection of claims 4, 21, 41, and 61 under 35 U.S.C. § 103(a), and the rejection should be reversed.

Criterion 2 - No Reasonable Expectation of Success

The criterion that there must be a reasonable expectation of success with the proposed combination can not be met. There could be no combination of the Fink reference and the Prada reference that would provide a reasonable expectation of success or that would show Applicants' invention of amended claims 4, 21, 41, and 61.

Both the Fink reference and the Prada reference fail to disclose Applicants' claimed combination of claim elements identified above. Since these elements are missing from both references there could be no combination of the two references that would have reasonable expectation of success of providing Applicant's invention of amended claims 4, 21, 41, and 61.

Thus, the combination of the Fink and Prada references in the Final Rejection mailed August 15, 2008 fails to support a rejection of claims 4, 21, 41, and 61 under 35 U.S.C. § 103(a), and the rejection should be reversed.

Criterion 3 – No Reasons for Combining the References

The criterion that the Examiner must follow the "Examination Guidelines for Determining Obviousness in Light of the Supreme Court's KSR v. Teleflex Decision" published October 10, 2007" can not be met. These guidelines include the requirement that the Examiner provide reasons for combining the references to produce the proposed combination.

The only stated reasons for the proposed combination the Fink and Prada references in the Final Rejection mailed August 15, 2008 are quoted below.

> "It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate eigen analysis, as taught by Prada, in the system of Fink because each eigenvector of the time reversal operator is associated to on of the point-like targets, thereby allowing focusing on specific scatterers."

The stated reasons are not valid reasons for combining the Fink and Prada references. The Fink reference requires forming, starting from a target constituting a secondary source 10, an ultrasonic pressure field focussed on the target, by an ultrasonic phase conjugation mirror technique. The target may for instance be a stone to be destroyed in human tissues. It may also be a fault in a solid part. During a first step, the zone in which a target 10 is to be localized is illuminated with a wide non-focused beam. During a second step of the process, the echo received by the transducers is transformed into electric signals and the shapes and relative positions in time of the signals are stored by a circuit. During the next step, the stored signals are used for generation of signals energizing the transducers of the reception array, after reversal of the distribution in time and of the shape of the signal.

The Prada reference is a method of detection and selective focusing in multiple target media. The method is based on the time reversal concept. A time reversal operator is introduced, the eigenvectors of which are linked to the targets. The eigenvalue depends on the reflectivity of the target and the eigenvector provides the phase and amplitude law to focus on the target.

There are no valid reasons for combining the Fink ultrasonic pressure field focussed on the target and the Prada detection and selective focusing in multiple target media. Further, there could be no combination of the Fink reference and the Prada reference that would show Applicant's invention of amended claims 4, 21, 41, and 61. Further, a combination of the Fink reference and the Prada reference would not show Applicant's invention of amended claims 4, 21, 41, and 61.

Thus, the combination of the Fink and Prada references in the Final Rejection mailed August 15, 2008 fails to support a rejection of claims 4, 21, 41, and 61 under 35 U.S.C. § 103(a), and the rejection should be reversed.

Argument Relating to Grounds of Rejection #2

The rejection in grounds of rejection #2 is respectfully traversed because claims 5-8, 22-25, 42-45, and 62-65 are not obvious over the Fink, Prada, and Candy references and Appellants' claims 5-8, 22-25, 42-45, and 62-65 are patentable. The Fink and Prada references are described above.

The Candy Reference

The Candy reference is U.S. Published Patent Application No. 2001/0037075 illustrated in FIG. 1A reproduced below and described in the portions of the Candy reference quoted below.

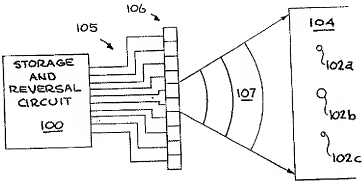


FIG. 1A

"[0019] In operation, initially an unfocused beam 107 will be sent toward the scatterers 102*a*- 102*c* from the transceiver elements of array 106. The scatterers 102*a*-102*c* will constitute secondary sources due to reflection (or echoes) from their surfaces. FIG. 1B discloses the next step of the process whereby reflections 108, 109 and 110 from scatterers 102*a*-102 *c* are received by the transceiver elements of the array 106 and transformed into electrical signals traveling on connectors 105 . The larger scatterer 102*b* returns a strong reflection 109 and the smaller scatterers 102*a* and 102*c* return weaker reflections 108 and 110 (shown in dotted lines to indicate weaker signals). The storage and reversal circuit 100 stores the shape and position in time (i.e., time series measurement data) of the electrical signals. During the next step, the time series measurement data is time-reversed (which will be discussed in detail below) and after several iterations, the strongest scatterer 102*b* is focused on, separated and removed from the time series measurement data. In a next step, array 106 transmits wavefronts 112 and 114 as shown in FIG. 1C. Wave fronts 112 and 114 illuminate other scatterers including 102*a* and 102*c*. FIG. 1D shows the newly reflected wave fronts 116 and 119. Reflected wavefront 116 is greater in strength than reflected wavefront 119 because scatterer 102*a* is larger in size than scatterer 102*c* and thus a greater reflector. Again, the data is time-reversed in the storage and reversal circuit 100 and after several iterations, focusing on scatterer 102*a* occurs and it is separated and removed from the time series measurement data. In a next step, array 106 transmits wavefront 122 as shown in FIG. 1E. FIG. 1F shows the reflected wavefront 125. Reflected wave front 125 from scatterer 102*c* is the strongest and scatterer 102 *c* is identified as the third largest scatterer. Iterations of this process may be repeated a plurality of times and each time removing the scatters from the time series measurement data until a map of substantially all of the scatterers in the inhomogenous medium 104 is made. After identification of all of the

scatterers in the medium 104 is made, the storage and reversal circuit 100 may concentrate ultrasound waves on the scatterers that are to be destroyed."

There is No *Prima Facie* Case of Obviousnes

There is no *Prima Facie* case of obviousness that would support the rejection of claims 5-8, 22-25, 42-45, and 62-65 over the Fink, Prada, and Candy references under 35 U.S.C. § 103(a). The factual inquiries set forth in Graham v. John Deere Co., 383 U.S. 1, 148 USPQ 459 (1966) that are applied for establishing a background for determining obviousness under 35 U.S.C. § 103(a) include, "Ascertaining the differences between the prior art and the claims at issue." The Examiner bears the initial burden of factually supporting a *prima facie* conclusion of obviousness (M.P.E.P. Section 2142). Three basic criteria must be met in order for the Examiner to establish a *prima facie* case of obviousness.

Criterion 1 - The prior art reference (or reference when combined) must teach or suggest all the claim limitations.

Criterion 2 - There must be a reasonable expectation of success with the proposed combination.

Criterion 3 - The Examiner must follow the "Examination Guidelines for Determining Obviousness in Light of the Supreme Court's KSR v. Teleflex Decision" published October 10, 2007. These guidelines include the requirement that the Examiner provide reasons for combining the references to produce the proposed combination.

Criterion 1 - References Do Not Teach All Claim Limitations

The criterion that prior art reference, or references when combined, must teach or suggest all the claim limitations can not be met. With reference to the descriptions of the Fink, Prada, and Candy references above, it is clear that the

references fail to teach the following claim limitations of Applicants' claims 5-8, 22-25, 42-45, and 62-65:

Claim 5
"wherein said step of developing temporal signatures to drive said acoustical energy on said mass includes a step of acquiring multistatic data matrix using sets of orthogonal weights to increase signal-to-noise ratio."

Claim 6
"wherein said step of dynamic focusing said acoustical energy on said mass utilizes time reversal eigen-decomposition includes selecting eigen-weights and said eigen-weights are selected so that corresponding singular values fit a desired pattern."

Claim 7
"wherein said step of dynamic focusing said acoustical energy on said mass utilizes time reversal eigen-decomposition includes selecting eigen-weights and said eigen-weights are selected to minimize the error with a given reference."

Claim 8
"wherein said reference is calculated using a simple propagation model."

Claim 22
"wherein said step of developing temporal signatures to drive said acoustical energy on said mass includes a step of acquiring multistatic data matrix that uses sets of orthogonal weights to increase signal-to-noise ratio."

Claim 23
"wherein said step of dynamic focusing said acoustical energy on said mass utilizes time reversal eigen-decomposition includes selecting eigen-weights and said eigen-weights are selected so that corresponding singular values fit a desired pattern."

Claim 24
"wherein said step of dynamic focusing said acoustical energy on said mass utilizes time reversal eigen-decomposition includes selecting eigen-weights and wherein said eigen-weights are selected to minimize the error with a given reference."

Claim 25
"wherein said reference is calculated using a simple propagation model."

Claim 42
"wherein said means for developing temporal signatures for driving said acoustical energy includes means for acquiring a multistatic data matrix that uses sets of orthogonal weights to increase signal-to-noise ratio."

Claim 43
"wherein said time reversal eigen-decomposition includes eigen-weights selected so that corresponding singular values fit a desired pattern."

Claim 44
"wherein said time reversal eigen-decomposition includes eigen-weights and wherein said eigen-weights are selected to minimize the error with a given reference."

Claim 45
"wherein said reference is calculated using a simple propagation model."

Claim 62
"wherein said means for developing temporal signatures for driving said acoustical energy includes means for acquiring a multistatic data matrix that uses sets of orthogonal weights to increase signal-to-noise ratio."

Claim 63
"wherein said time reversal eigen-decomposition includes eigen-weights and said eigen-weights are selected so that corresponding singular values fit a desired pattern."

Claim 64
"wherein said time reversal eigen-decomposition includes eigen-weights and said eigen-weights are selected to minimize the error with a given reference."

Claim 65
"wherein said reference is calculated using a simple propagation model."

Thus, the combination of the Fink, Prada, and Candy references in the Final Rejection mailed August 15, 2008 fails to support a rejection of claims 5-8, 22-25, 42-45, and 62-65 under 35 U.S.C. § 103(a), and the rejection should be reversed.

Criterion 2 - No Reasonable Expectation of Success

The criterion that there must be a reasonable expectation of success with the proposed combination can not be met. There could be no combination of the Fink reference and the Prada reference that would provide a reasonable expectation of success or that would show Applicants' invention of amended claims 5-8, 22-25, 42-45, and 62-65.

The Fink reference and the Prada reference and the Candy reference fail to disclose Applicants' claim limitation identified above. Since these claim limitations are missing from the three references there could be no combination of the three references that would have reasonable expectation of success of providing Applicant's invention of amended claims 5-8, 22-25, 42-45, and 62-65.

Thus, the combination of the Fink, Prada, and Candy references in the Final Rejection mailed August 15, 2008 fails to support a rejection of claims 5-8, 22-25, 42-45, and 62-65 under 35 U.S.C. § 103(a), and the rejection should be reversed.

Criterion 3 – No Reasons for Combining the References

The criterion that the Examiner must follow the "Examination Guidelines for Determining Obviousness in Light of the Supreme Court's KSR v. Teleflex Decision" published October 10, 2007" can not be met. These guidelines include the requirement that the Examiner provide reasons for combining the references to produce the proposed combination.

The only stated reasons for the proposed combination of the Fink, Prada, and Candy references in the Final Rejection mailed August 15, 2008 are quoted below.

> "While not explicitly stated in Candy, it is taught that the eigen-value analysis of Prada allows one of skill in the art to focus on individual scattering signals based on individual scatterers with the use of the eigenvalues *(see page* 158), thereby *providing a means to apply weights, as*

> taught by Candy. It would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate eigen analysis to provide weighting, as taught by Candy, in order to reconstruct a combined total received field of weighted individual scattered fields from estimates of each of the strongest scatterers (paragraph 30)."

The stated reasons are not valid reasons for combining the Fink, Prada, and Candy references. The Fink reference requires forming, starting from a target constituting a secondary source 10, an ultrasonic pressure field focussed on the target, by an ultrasonic phase conjugation mirror technique. The target may for instance be a stone to be destroyed in human tissues. It may also be a fault in a solid part. During a first step, the zone in which a target 10 is to be localized is illuminated with a wide non-focused beam. During a second step of the process, the echo received by the transducers is transformed into electric signals and the shapes and relative positions in time of the signals are stored by a circuit. During the next step, the stored signals are used for generation of signals energizing the transducers of the reception array, after reversal of the distribution in time and of the shape of the signal.

The Prada reference is a method of detection and selective focusing in multiple target media. The method is based on the time reversal concept. A time reversal operator is introduce, the eigenvectors of which are linked to the targets. The eigenvalue depends on the reflectivity of the target and the eigenvector provides the phase and amplitude law to focus on the target.

In the Candy reference an unfocused beam 107 will be sent toward the scatterers 102*a*- 102*c* from the transceiver elements of array 106. The larger scatterer 102*b* returns a strong reflection 109 and the smaller scatterers 102*a* and 102*c* return weaker reflections 108 and 110. During the next step, the time series measurement data is time-reversed and after several iterations, the strongest scatterer 102*b* is focused on, separated and removed from the time series

measurement data. Again, the data is time-reversed in the storage and reversal circuit 100 and after several iterations, focusing on scatterer 102*a* occurs and it is separated and removed from the time series measurement data. Iterations of this process may be repeated a plurality of times and each time removing the scatters from the time series measurement data until a map of substantially all of the scatterers in the inhomogenous medium 104 is made. After identification of all of the scatterers in the medium 104 is made, the storage and reversal circuit 100 may concentrate ultrasound waves on the scatterers that are to be destroyed."

There are no valid reasons for combining the Fink ultrasonic pressure field focused on the target and the Prada detection and selective focusing in multiple target media and the Candy unfocused beam sent toward the larger scatterer that returns a strong reflection and the smaller scatterers that return weaker reflections, wherein after several iterations, the strongest scatterer is focused on, separated and removed from the time series measurement data.

Further, there could be no combination of the Fink reference and the Prada reference and the Candy reference that would show Applicant's invention of amended claims 5-8, 22-25, 42-45, and 62-65. Further, a combination of the Fink reference and the Prada reference and the Candy reference would not show Applicant's invention of amended claims 5-8, 22-25, 42-45, and 62-65.

Thus, the combination of the Fink, Prada, and Candy references in the Final Rejection mailed August 15, 2008 fails to support a rejection of claims 5-8, 22-25, 42-45, and 62-65 under 35 U.S.C. § 103(a), and the rejection should be reversed.

SUMMARY

None of the references show Appellants' claimed invention and it would not be obvious to combine the three references to meet Appellants'' claims 4-8, 21-25, 41-45, and 61-65 on appeal. It is respectfully requested that the rejection of claims 4-8, 21-25, 41-45, and 61-65 be reversed and that claims 4-8, 21-25, 41-45, and 61-65 on appeal be allowed.

Respectfully submitted,

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VIII. CLAIMS APPENDIX

4. A method of noninvasively focusing acoustical energy on a mass within a substance to reduce or eliminate said mass, comprising the steps of:

detecting the presence of said mass in said substance by applying acoustic energy to said substance,

localizing said mass to determine its position within said substance,

developing temporal signatures to drive said acoustical energy on said mass, and

dynamic focusing said acoustical energy on said mass in said substance utilizing said temporal signatures to reduce or eliminate said mass, wherein said step of dynamic focusing said acoustical energy on said mass utilizes time reversal eigen-decomposition.

5. The method of noninvasively focusing acoustical energy on a mass of claim 4 wherein said step of developing temporal signatures to drive said acoustical energy on said mass includes a step of acquiring multistatic data matrix using sets of orthogonal weights to increase signal-to-noise ratio.

6. The method of noninvasively focusing acoustical energy on a mass of claim 4 wherein said step of dynamic focusing said acoustical energy on said mass utilizes time reversal eigen-decomposition includes selecting eigen-weights and said eigen-weights are selected so that corresponding singular values fit a desired pattern.

7. The method of noninvasively focusing acoustical energy on a mass of claim 4 wherein said step of dynamic focusing said acoustical energy on said mass utilizes time reversal eigen-decomposition includes selecting eigen-weights and said eigen-weights are selected to minimize the error with a given reference.

8. The method of noninvasively focusing acoustical energy on a mass of claim 7 wherein said reference is calculated using a simple propagation model.

21. A method of treating tissue by noninvasively focusing acoustical energy on a mass within said tissue to reduce or eliminate said mass, comprising the steps of:

detecting the presence of said mass in said tissue by applying acoustic energy to said tissue,

localizing said mass to determine its position within said tissue,

developing temporal signatures to drive said acoustical energy on said mass, and

dynamic focusing said acoustical energy on said mass in said tissue utilizing said temporal signatures to reduce or eliminate said mass wherein said step of dynamic focusing said acoustical energy on said mass utilizes time reversal eigen-decomposition.

22. The method of treating tissue of claim 21 wherein said step of developing temporal signatures to drive said acoustical energy on said mass includes a step of acquiring multistatic data matrix that uses sets of orthogonal weights to increase signal-to-noise ratio.

23. The method of treating tissue of claim 21 wherein said step of dynamic focusing said acoustical energy on said mass utilizes time reversal eigen-decomposition includes selecting eigen-weights and said eigen-weights are selected so that corresponding singular values fit a desired pattern.

24. The method of treating tissue of claim 21 wherein said step of dynamic focusing said acoustical energy on said mass utilizes time reversal eigen-decomposition includes selecting eigen-weights and wherein said eigen-weights are selected to minimize the error with a given reference.

25. The method of treating tissue of claim 24 wherein said reference is calculated using a simple propagation model.

41. A system of noninvasively focusing acoustical energy on a mass in a substance to reduce or eliminate said mass, comprising:

means for applying acoustic energy to said substance for detecting said mass,

means for localizing said mass,

means for developing temporal signatures for driving said acoustical energy, and

means for dynamic focusing said acoustical energy through said substance on said mass to reduce or eliminate said mass wherein of means for dynamic focusing said acoustical energy on said mass utilizes time reversal eigen-decomposition.

42. The system of noninvasively focusing acoustical energy on a mass of claim 41 wherein said means for developing temporal signatures for driving said acoustical energy includes means for acquiring a multistatic data matrix that uses sets of orthogonal weights to increase signal-to-noise ratio.

43. The system of noninvasively focusing acoustical energy on a mass of claim 41 wherein said time reversal eigen-decomposition includes eigen-weights selected so that corresponding singular values fit a desired pattern.

44. The system of noninvasively focusing acoustical energy on a mass of claim 41 wherein said time reversal eigen-decomposition includes eigen-weights and wherein said eigen-weights are selected to minimize the error with a given reference.

45. The system of noninvasively focusing acoustical energy on a mass of claim 44 wherein said reference is calculated using a simple propagation model.

61. A system of treating tissue by treating tissue within said tissue to reduce or eliminate said mass, comprising:

means for applying acoustic energy to said substance for detecting said mass,

means for localizing said mass,

means for developing temporal signatures for driving said acoustical energy, and

means for dynamic focusing said acoustical energy through said substance on said mass to reduce or eliminate said mass wherein said means for dynamic focusing said acoustical energy on said mass utilizes time reversal eigen-decomposition.

62. The system of treating tissue of claim 61 wherein said means for developing temporal signatures for driving said acoustical energy includes means for acquiring a multistatic data matrix that uses sets of orthogonal weights to increase signal-to-noise ratio.

63. The system of treating tissue of claim 61 wherein said time reversal eigen-decomposition includes eigen-weights and said eigen-weights are selected so that corresponding singular values fit a desired pattern.

64. The system of treating tissue of claim 61 wherein said time reversal eigen-decomposition includes eigen-weights and said eigen-weights are selected to minimize the error with a given reference.

65. The system of treating tissue of claim 64 wherein said reference is calculated using a simple propagation model.

IX. EVIDENCE APPENDIX

There are no entries in the Evidence Appendix.

X. RELATED PROCEEDINGS APPENDIX

There are no entries in the Related Proceedings Appendix.